

CLAIMS

1 A stent in a non-expanded state, comprising:
2 a first expansion strut pair including a first expansion strut positioned
3 adjacent to a second expansion strut and a joining strut of the first expansion
4 strut pair that couples the first and second expansion struts at a distal end of the
5 first expansion strut pair, a plurality of the first expansion strut pair forming a
6 first expansion column;
7 a second expansion strut pair including a first expansion strut positioned
8 adjacent to a second expansion strut and a joining strut of the second
9 expansion strut pair that couples the first and second expansion struts of the
10 second expansion strut pair at a proximal end of the second expansion strut
11 pair, a plurality of the second expansion strut pair forming a second expansion
12 column;
13 a first connecting strut including a first connecting strut proximal
14 section, a first connecting strut distal section and a first connecting strut
15 intermediate section, the first connecting strut proximal section being coupled
16 to the distal end of the first expansion strut pair in the first expansion column
17 and the first connecting strut distal section being coupled to the proximal end of
18 the second expansion strut pair of the second expansion column, a plurality of
19 the first connecting strut forming a first connecting strut column that couples
20 the first expansion column to the second expansion column, wherein a length of
21 the first connecting strut proximal section is equal to a length of the first
22 connecting strut distal section, and a length of the first connecting strut
23 intermediate section is greater than the length of the first connecting strut
24 proximal and distal sections.

1 2. The stent of claim 1, wherein the first expansion strut of the first
2 expansion strut pair in the first expansion column has a longitudinal axis offset
3 from a longitudinal axis of the first expansion strut of the second expansion
4 strut pair in the second expansion column.

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1 3. The stent of claim 1, wherein a spacing distance between the
2 first expansion column strut pair and an adjacent first expansion column strut
3 pair in the first expansion column are the same.

1 4. The stent of claim 1, wherein a spacing distance between the
2 second column expansion strut pair and an adjacent second column expansion
3 strut pair in the second expansion column are different.

1 5. The stent of claim 1, wherein a spacing distance between the
2 first expansion column strut pair and an adjacent first expansion column strut
3 pair in the first expansion column, and a spacing distance between the second
4 column expansion strut pair and an adjacent second column expansion strut
5 pair in the second expansion column are the same.

1 6. The stent of claim 1, wherein a spacing distance between the
2 first expansion column strut pair and an adjacent first expansion column strut
3 pair in the first expansion column, and a spacing distance between the second
4 column expansion strut pair and an adjacent second column expansion strut
5 pair in the second expansion column are different.

1 6 7. The stent of claim 1, wherein a first radius of curvature is
2 formed where the first connecting strut proximal section is coupled to the first
3 connecting strut intermediate section.

1 7 8. The stent of claim 1, wherein a second radius of curvature is
2 formed where the first connecting strut distal section is coupled to the first
3 connecting strut intermediate section.

1 8 9. The stent of claim 1, wherein a first radius of curvature is
2 formed where the first connecting strut proximal section is coupled to the first
3 connecting strut intermediate section and a second radius of curvature is formed

4 where the first connecting strut distal section is coupled to the first connecting
5 strut intermediate section.

1 9 10. The stent of claim 1, wherein a first slant angle is formed where
2 the first connecting strut proximal section is coupled to the first connecting
3 strut intermediate section.

1 10 11. The stent of claim 1, wherein a second slant angle is formed
2 where the first connecting strut distal section is coupled to the first connecting
3 strut intermediate section.

1 11 12. The stent of claim 1, wherein a first slant angle is formed where
2 the first connecting strut proximal section is coupled to the first connecting
3 strut intermediate section and a second slant angle is formed where the first
4 connecting strut distal section is coupled to the first connecting strut
5 intermediate section.

1 12 13. The stent of claim 1, wherein the stent further includes a
2 radiopaque marker.

1 13 14. The stent of claim 1, wherein the stent includes an electroplated
2 material for radiopaque observation under fluoroscopy.

1 14 15. The stent of claim 1, wherein a proximal end and a distal end of
2 the stent are at least partially radiopaque electroplated.

1 15 16. The stent of claim 1, wherein a ratio of a number of expansion
2 struts in an expansion strut column to a number of connecting struts in a
3 connecting strut column is 2 to 1.

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1 16 17. The stent of claim 1, wherein the stent includes m first and
2 second expansion columns, n expansion struts per column and n (m-1)/2
3 connecting struts.

1 17 18. The stent of claim 1, wherein the first and second expansion
2 columns are each unbroken, continuous structures.

1 18 19. The stent of claim 1, further comprising:
2 a reinforcement expansion column made of a plurality of reinforcement
3 expansion struts, wherein each reinforcement expansion strut has a width that
4 is greater than a width of an expansion strut in the first or second expansion
5 columns.

1 19 20. The stent of claim 19, wherein the reinforcement expansion
2 column includes a plurality of relief notches.

1 20 21. The stent of claim 1, wherein the stent has a proximal end with a
2 first reinforcement expansion column and a distal end with a second
3 reinforcement expansion column.

1 21 22. The stent of claim 21, wherein the first and second
2 reinforcement expansion columns each include a plurality of relief notches.

1 22 23. The stent of claim 21, further comprising:
2 a third reinforcement expansion column intermediate the stent proximal
3 end and the stent distal end.

1 24. A stent in a non-expanded state, comprising:
2 a first expansion column formed of a plurality of first expansion column
3 strut pairs, a first expansion strut pair including a first expansion strut adjacent
4 to a second expansion strut and a first joining strut that couples the first and

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5 second expansion struts at a proximal end of the first expansion strut pair, a
6 second expansion strut pair including a third expansion strut adjacent to the
7 second expansion strut and a second joining strut that couples the second and
8 third expansion struts at a distal end of the second expansion strut pair, a third
9 expansion strut pair including a fourth expansion strut adjacent to the third
10 expansion strut and a third joining strut that couples the third and fourth
11 expansion struts at a proximal end of the third expansion strut pair, a fourth
12 expansion strut pair including a fifth expansion strut adjacent to the fourth
13 expansion strut and a fourth joining strut that couples the fourth and fifth
14 expansion struts at a distal end of the fourth expansion strut pair, a first
15 expansion strut pair first corner formed where the first joining strut is coupled
16 to the first expansion strut, and a first expansion strut pair second corner
17 formed where the first joining strut is coupled to the second expansion strut,
18 and a second expansion strut pair first corner formed where the second joining
19 strut is coupled to the second expansion strut, and a second expansion strut pair
20 second corner formed where the second joining strut is coupled to the third
21 expansion strut, and a third expansion strut pair first corner formed where the
22 third joining strut is coupled to the third expansion strut, and a third expansion
23 strut pair second corner formed where the third joining strut is coupled to the
24 fourth expansion strut, and a fourth expansion strut pair first corner formed
25 where the fourth joining strut is coupled to the fourth expansion strut, and a
26 fourth expansion strut pair second corner formed where the fourth joining strut
27 is coupled to the fifth expansion strut;

28 a second expansion column formed of a plurality of second expansion
29 column strut pairs, a first expansion strut pair including a first expansion strut
30 adjacent to a second expansion strut and a first joining strut that couples the
31 first and second expansion struts at a proximal end of the first expansion strut
32 pair, a second expansion strut pair including a third expansion strut adjacent to
33 the second expansion strut and a second joining strut that couples the second
34 and third expansion struts at a distal end of the second expansion strut pair, a
35 third expansion strut pair including a fourth expansion strut adjacent to the

36 third expansion strut and a third joining strut that couples the third and fourth
 37 expansion struts at a proximal end of the third expansion strut pair, a fourth
 38 expansion strut pair including a fifth expansion strut adjacent to the fourth
 39 expansion strut and a fourth joining strut that couples the fourth and fifth
 40 expansion struts at a distal end of the fourth expansion strut pair, a first
 41 expansion strut pair first corner formed where the first joining strut is coupled
 42 to the first expansion strut, and a first expansion strut pair second corner
 43 formed where the first joining strut is coupled to the second expansion strut,
 44 and a second expansion strut pair first corner formed where the second joining
 45 strut is coupled to the second expansion strut, and a second expansion strut pair
 46 second corner formed where the second joining strut is coupled to the third
 47 expansion strut, and a third expansion strut pair first corner formed where the
 48 third joining strut is coupled to the third expansion strut, and a third expansion
 49 strut pair second corner formed where the third joining strut is coupled to the
 50 fourth expansion strut, and a fourth expansion strut pair first corner formed
 51 where the fourth joining strut is coupled to the fourth expansion strut, and a
 52 fourth expansion strut pair second corner formed where the fourth joining strut
 53 is coupled to the fifth expansion strut; and

54 a first connecting strut column formed of a plurality of first connecting
 55 struts, each connecting strut of the first connecting strut column including a
 56 connecting strut proximal section, a connecting strut distal section and a
 57 connecting strut intermediate section, a first connecting strut proximal section
 58 is coupled to the joining strut of the second expansion strut pair of the first
 59 expansion strut column, and a first connecting strut distal section is coupled to
 60 the joining strut of the first expansion strut pair of the second expansion strut
 61 column, and a second connecting strut proximal section is coupled to the
 62 joining strut of the fourth expansion strut pair of the first expansion strut
 63 column, and a second connecting strut distal section is coupled to the joining
 64 strut of the third expansion strut pair of the second expansion strut column,
 65 wherein a length of the connecting strut proximal section is the same as a
 66 length of the connecting strut distal section and the connecting strut

67 intermediate section has a length that is greater than the lengths of the
68 connecting strut distal and proximal sections.

1 24/ 25. The stent of claim 24, wherein the stent includes a proximal
2 expansion column, a distal expansion column, a plurality of connecting struts
3 positioned between the proximal and distal expansion columns, and a plurality
4 of expansion columns positioned between the proximal and distal expansion
5 columns, each expansion column being made of a plurality of juxtapositioned
6 proximal and distal looped slots.

1 25/ 26. The stent of claim 24, wherein the first expansion column, the
2 second expansion column, and the first connecting strut column form a
3 plurality of geometric cells.

1 26/ 27. The stent of claim 26, wherein at least a portion of the plurality
2 are asymmetrical geometric cells.

1 27/ 28. The stent of claim 24, wherein the first expansion column, the
2 second expansion column, and the first connecting strut column form a
3 plurality of cells and at least a portion of the plurality of cells form non-uniform
4 cell space patterns.

1 28/ 29. The stent of claim 24, wherein the first expansion strut column,
2 the second expansion strut column and the first connecting strut column form a
3 plurality of geometric configurations and at least a portion of the plurality form
4 asymmetrical geometric configurations.

1 29/ 30. The stent of claim 24, wherein the first expansion strut column,
2 the second expansion strut column and the first connecting strut column form a
3 plurality of geometric configurations and at least a portion of the plurality form
4 symmetrical geometric configurations.

30 31. The stent of claim 24, wherein the first connecting strut proximal section is coupled to the joining strut of the second expansion strut pair of the first expansion strut column, and the first connecting strut distal section is coupled to the first corner of the first expansion strut pair of the second expansion strut column, and the second connecting strut proximal section is coupled to the joining strut of the fourth expansion strut pair of the first expansion strut column, and the second connecting strut distal section is coupled to the first corner of the third expansion strut pair of the second expansion strut column.

31 32. The stent of claim 24, wherein the first connecting strut proximal section is coupled to the joining strut of the second expansion strut pair of the first expansion strut column, and the first connecting strut distal section is coupled to the second corner of the first expansion strut pair of the second expansion strut column, and the second connecting strut proximal section is coupled to the joining strut of the fourth expansion strut pair of the first expansion strut column, and the second connecting strut distal section is coupled to the second corner of the third expansion strut pair of the second expansion strut column.

32 33. The stent of claim 24, wherein the first connecting strut proximal section is coupled to the first corner of the second expansion strut pair of the first expansion strut column, and the first connecting strut distal section is coupled to the joining strut of the first expansion strut pair of the second expansion strut column, and the second connecting strut proximal section is coupled to the first corner of the fourth expansion strut pair of the first expansion strut column, and the second connecting strut distal section is coupled to the joining strut of the third expansion strut pair of the second expansion strut column.

1 ²³ 34 37. The stent of claim 24, wherein the first connecting strut
 2 proximal section is coupled to the second corner of the second expansion strut
 3 pair of the first expansion strut column, and the first connecting strut distal
 4 section is coupled to the first corner of the first expansion strut pair of the
 5 second expansion strut column, and the second connecting strut proximal
 6 section is coupled to the second corner of the fourth expansion strut pair of the
 7 first expansion strut column, and the second connecting strut distal section is
 8 coupled to the first corner of the third expansion strut pair of the second
 9 expansion strut column.

1 ²³ 37 38. The stent of claim 24, wherein the first connecting strut
 2 proximal section is coupled to the second corner of the second expansion strut
 3 pair of the first expansion strut column, and the first connecting strut distal
 4 section is coupled to the second corner of the first expansion strut pair of the
 5 second expansion strut column, and the second connecting strut proximal
 6 section is coupled to the second corner of the fourth expansion strut pair of the
 7 first expansion strut column, and the second connecting strut distal section is
 8 coupled to the second corner of the third expansion strut pair of the second
 9 expansion strut column.

1 ²³ 38 39. The stent of claim 24, wherein the first column expansion strut
 2 pairs define first column loop slots, and the second column expansion strut
 3 pairs define second column loop slots.

1 ³⁸ 39 40. The stent of claim 39, wherein the first column loop slots are
 2 parallel to the second column loop slots.

1 ³⁸ 40 41. The stent of claim 39, wherein the first column loop slots are not
 2 parallel to the second column loop slots.

1 41/42. The stent of claim 38, wherein the first column loop slots are
2 longitudinally offset from the second column loop slots.

1 42/43. The stent of claim 38, wherein the first column loop slots are
2 non-collinear to the second column loop slots.

1 43/44. The stent of claim 38, wherein the first column loop slots are
2 collinear with the second column loop slots.

1 44/45. The stent of claim 38, wherein a width of first column loop slots
2 is the same as a width of second column loop slots.

1 45/46. The stent of claim 38, wherein a width of the first column loop
2 slots is different than a width of the second column loop slots.

1 46/47. The stent of claim 38, wherein a shape of the first column loop
2 slots is different than a shape of the second column loop slots.

1 47/48. The stent of claim 38, wherein a shape of the first column loop
2 slots is the same as a shape of the second column loop slots.

1 48/49. The stent of claim 38, wherein a shape of a first column loop
2 slot of the first expansion column is different from a shape of an adjacent first
3 column loop slot of the first expansion column.

1 49/50. The stent of claim 38, wherein a shape of a first column loop
2 slot of the first expansion column is the same as a shape of an adjacent first
3 column loop slot of the first expansion column.

1 50/ 51. The stent of claim 39, wherein a width of a first column loop
2 slot of the first expansion column is different from a width of an adjacent first
3 column loop slot of the first expansion column.

1 51/ 52. The stent of claim 39, wherein a width of a first column loop
2 slot of the first expansion column is the same as a width of an adjacent first
3 column loop slot of the first expansion column.

1 52/ 53. The stent of claim 23, wherein each connecting strut proximal
2 section has a substantially linear geometry.

1 53/ 54. The stent of claim 23, wherein each connecting strut distal
2 section has a substantially linear geometry.

1 54/ 55. The stent of claim 23, wherein each connecting strut
2 intermediate section has a substantially linear geometry.

1 55/ 56. The stent of claim 23, wherein a ratio of a number of expansion
2 struts in an expansion strut column to a number of connecting struts in a
3 connecting strut column is 2 to 1.

1 56/ 57. The stent of claim 23, wherein the stent includes m first and
2 second expansion columns, n connecting struts per column and $n(m-1)/2$
3 connecting struts.

1 57/ 58. The stent of claim 23, wherein the first and second expansion
2 columns are each unbroken, continuous column structures.

1 58/ 59. The stent of claim 23, wherein one of the first or second
2 expansion column is a broken column structure.

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59/ 60. The stent of claim 24, further comprising:
a plurality of first expansion columns;
a plurality of second expansion columns; and
a plurality of first connecting strut columns, each first connecting strut
column coupling a first expansion column to a second expansion column.

60/ 61. The stent of claim 60, wherein a plurality of first expansion
columns, second expansion columns and first connecting strut columns form a
continuous a chain mesh strut frame pattern.

61/ 62. The stent of claim 60, wherein the plurality of first expansion
columns, the plurality of second expansion columns and the plurality of first
connecting strut columns form an elongated structure.

62/ 63. The stent of claim 24, further comprising:
a reenforcement expansion column made of a plurality of reenforcement
expansion struts, wherein each reenforcement expansion strut has a width that
is greater than a width of an expansion strut in the first or second expansion
columns.

63/ 64. The stent of claim 24, wherein the stent has a proximal end with
a first reenforcement expansion column and a distal end with a second
reenforcement expansion column.

64/ 65. The stent of claim 24, wherein the stent has a reenforcement
expansion column between a proximal end and a distal end of the stent.

65/ 66. The stent of claim 24, further comprising:
a third expansion column formed of a plurality of third expansion
column strut pairs, a first expansion strut pair including a first expansion strut
adjacent to a second expansion strut and a first joining strut that couples the

5 first and second expansion struts at a proximal end of the first expansion strut
6 pair, a second expansion strut pair including a third expansion strut adjacent to
7 the second expansion strut and a second joining strut that couples the second
8 and third expansion struts at a distal end of the second expansion strut pair, a
9 third expansion strut pair including a fourth expansion strut adjacent to the
10 third expansion strut and a third joining strut that couples the third and fourth
11 expansion struts at a proximal end of the third expansion strut pair, a fourth
12 expansion strut pair including a fifth expansion strut adjacent to the fourth
13 expansion strut and a fourth joining strut that couples the fourth and fifth
14 expansion struts at a distal end of the fourth expansion strut pair, a first
15 expansion strut pair first corner formed where the first joining strut is coupled
16 to the first expansion strut, and a first expansion strut pair second corner
17 formed where the first joining strut is coupled to the second expansion strut,
18 and a second expansion strut pair first corner formed where the second joining
19 strut is coupled to the second expansion strut, and a second expansion strut pair
20 second corner formed where the second joining strut is coupled to the third
21 expansion strut, and a third expansion strut pair first corner formed where the
22 third joining strut is coupled to the third expansion strut, and a third expansion
23 strut pair second corner formed where the third joining strut is coupled to the
24 fourth expansion strut, and a fourth expansion strut pair first corner formed
25 where the fourth joining strut is coupled to the fourth expansion strut, and a
26 fourth expansion strut pair second corner formed where the fourth joining strut
27 is coupled to the fifth expansion strut; and

28 a second connecting strut column formed of a plurality of second
29 connecting struts, each connecting strut of the second connecting strut column
30 including a connecting strut proximal section, a connecting strut distal section
31 and a connecting strut intermediate section, a first connecting strut proximal
32 section is coupled to the joining strut of the second expansion strut pair of the
33 second expansion strut column, and a first connecting strut distal section is
34 coupled to the joining strut of the first expansion strut pair of the third
35 expansion strut column, and a second connecting strut proximal section is

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36 coupled to the joining strut of the fourth expansion strut pair of the second
37 expansion strut column, and a second connecting strut distal section is coupled
38 to the joining strut of the third expansion strut pair of the third expansion strut
39 column.

1 ~~66~~ 67. The stent of claim ~~66~~ 65, wherein the first expansion strut of the
2 first expansion strut pair in the second expansion column has a longitudinal
3 axis offset from a longitudinal axis of the first expansion strut of the second
4 expansion strut pair in the third expansion column.

1 ~~67~~ 68. The stent of claim ~~66~~ 65, wherein the first expansion column, the
2 second expansion column, and the first connecting strut column form a first
3 plurality of geometric cells, and the second expansion column, the third
4 expansion column and the second connecting strut column form a second
5 plurality of geometric cells.

1 ~~68~~ 69. The stent of claim ~~68~~ 67, wherein at least a portion of the first
2 plurality of geometric cells and at least a portion of the second plurality of
3 geometric cells form asymmetric cells.

1 ~~69~~ 70. The stent of claim ~~68~~ 67, wherein at least a portion of the first
2 plurality of geometric cells and at least a portion of the second plurality of
3 geometric cells are symmetric cells.

1 ~~70~~ 71. The stent of claim ~~68~~ 67, wherein each geometric cell of the first
2 plurality includes a proximal looped slot and a distal looped slot, and each
3 geometric cell of the second plurality includes a proximal looped slot and a
4 distal looped slot.

85 86. The stent of claim 80, wherein the stent is tapered in an
 expanded state, and the balloon is tapered and curved in an expanded state.